

Improved transdisciplinary science for effective ecosystem-based maritime spatial planning and conservation in European Seas

Ibon Galparsoro Iza

Research of marine protected habitats in EEZ and determination of the necessary conservation status in Latvia



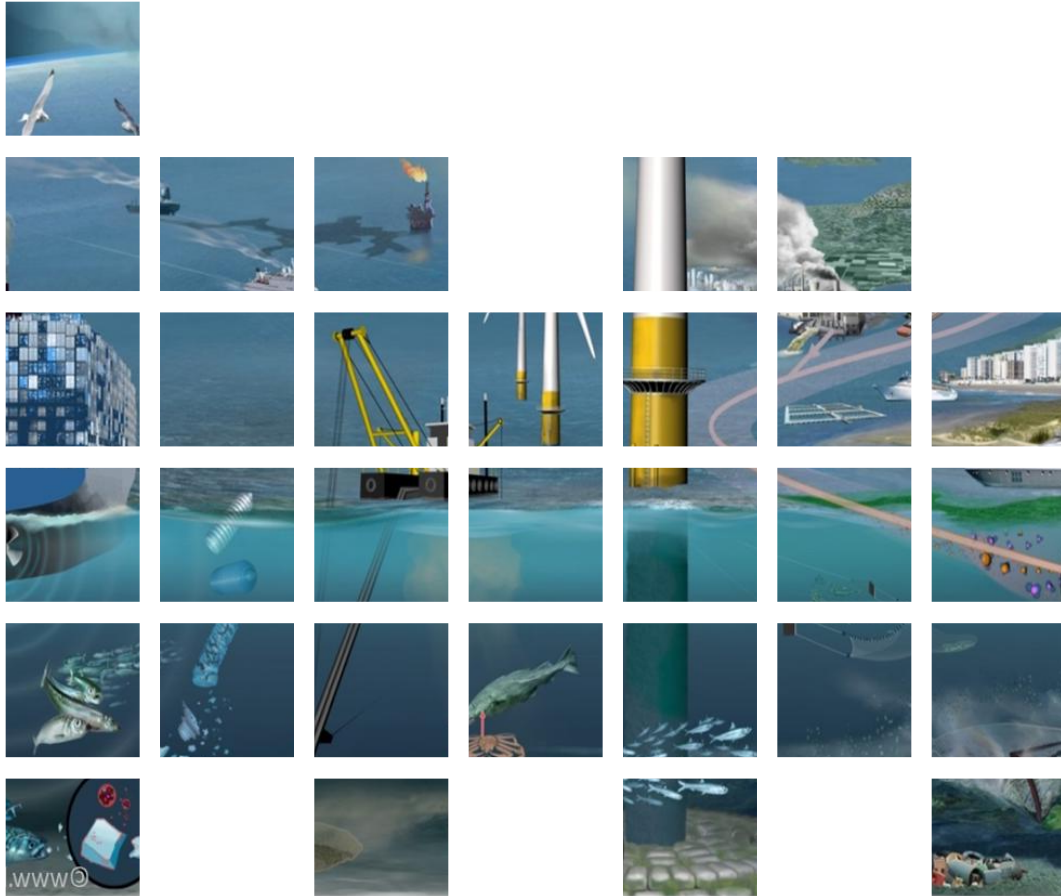
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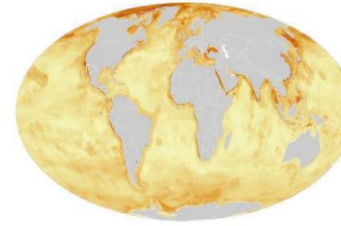
The Future of Marine Spatial Protection:
From Science to Policy
28-29 October 2025
Liepāja Latvian Society House

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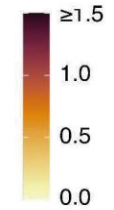
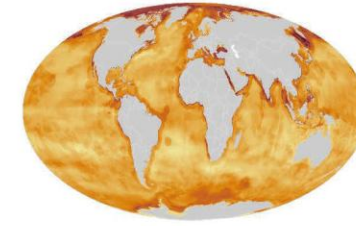
Global Increase of Human Pressures and Impacts



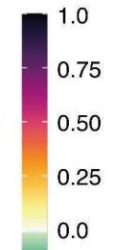
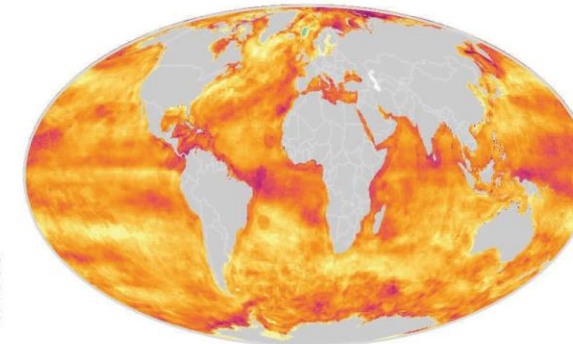
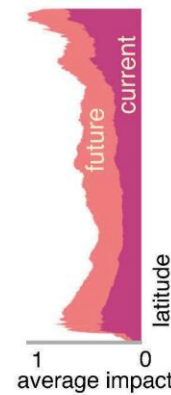
A Current cumulative impact



B Future projected impact



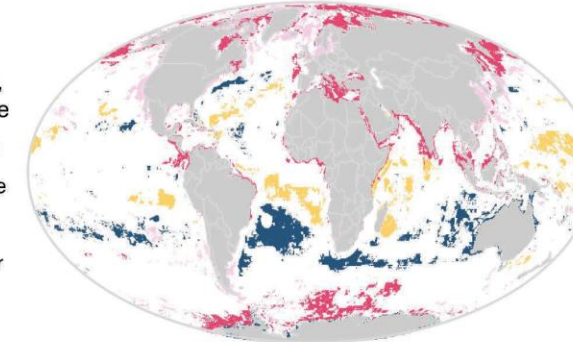
C Change in impact



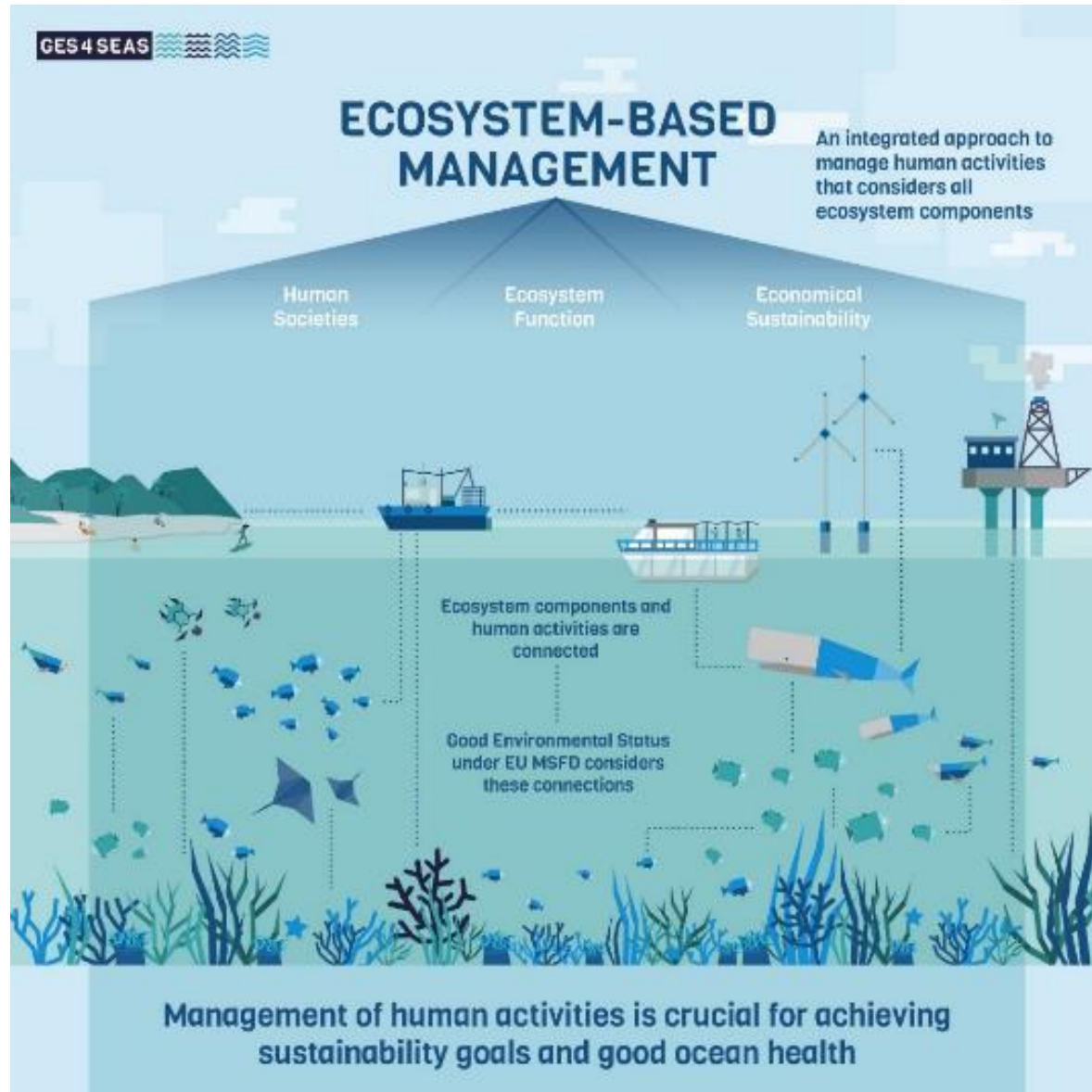
D Hotspots

current impact,
rate of increase

- lower, stable
- higher, stable
- lower, faster
- higher, faster



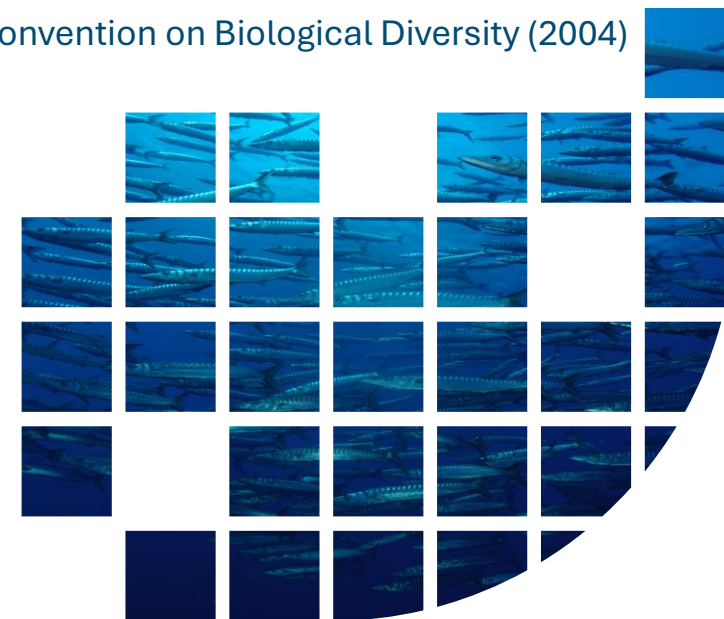
Need for Ecosystem-based Management (EBM)



www.ges4seas.eu

“An ecosystem-based approach is a strategy for integrated management that promotes equitable holistic protection and sustainable use, aligning with UN Convention on Biological Diversity (CBD) principles”

Secretariat of the Convention on Biological Diversity (2004)



Key Challenges for MSP to Enhance Marine Conservation



- Legal and institutional fragmentation (conservation vs. MSP processes) Galparsoro et al. 2025; Frazão Santos et al. 2025)
- Data gaps and uncertainties to understand and address socio-ecological impacts of planning at different scales (Kruse et al. 2024)
- Need for harmonised monitoring and evaluation strategies (Stelzenmüller et al. 2021)
- More transboundary and regional coordination to address ecosystem relevant scales in planning (Elliott et al. 2023)
- Lack of practical guidance for ecosystem-based MSP (Kirkfeld et al. 2022)

MarinePlan - Decision Support System



MarinePlan

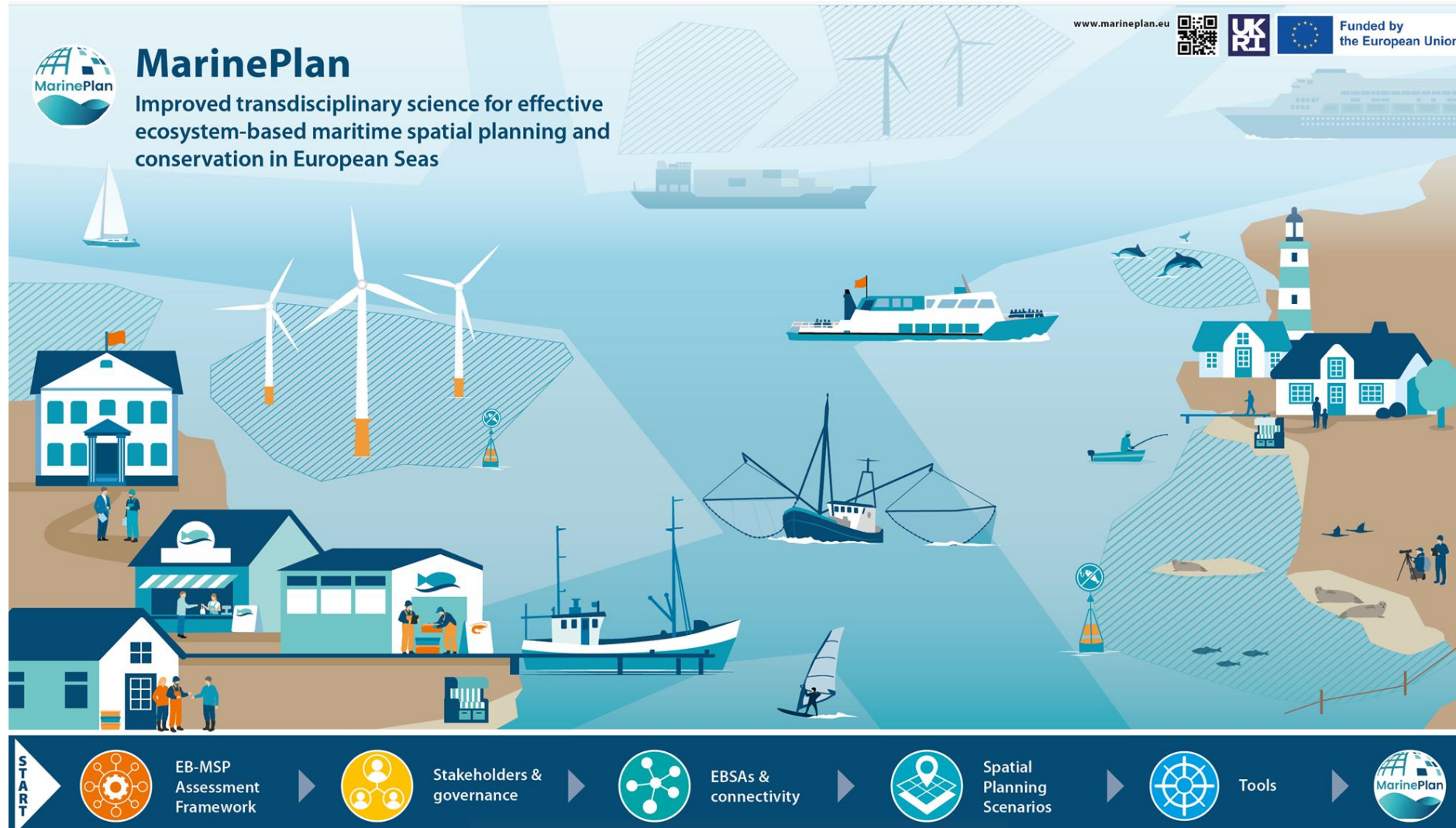
Improved transdisciplinary science for effective ecosystem-based maritime spatial planning and conservation in European Seas

www.marineplan.eu



Funded by
the European Union

- Assessment and strategic guidance towards EB-MSP
- EBSAs, and connectivity as ecological foundations
- Integration of natural and social science methodologies
- Planning site scenario development
- Co-development with stakeholders





Alignment of maritime spatial planning processes with ecosystem-based approach principles

Despite the recognition of its benefits, **EB-MSP is generally not fully implemented** in management plans

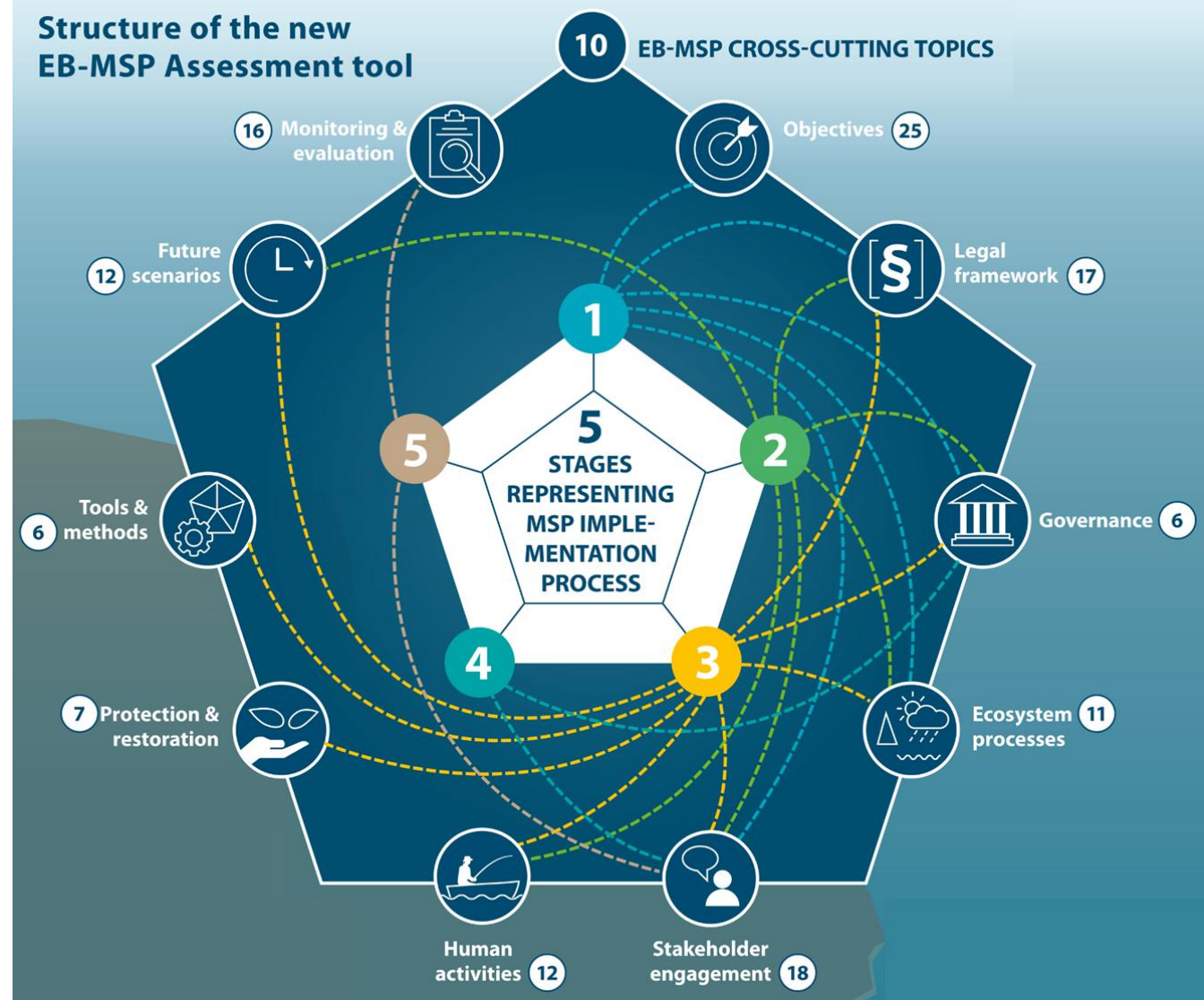
Current national MSP processes tend to emphasize specific issues and planning objectives, driving **context-specific approaches**

Aiming at promoting the capacity building of competent authorities and consultants, **a novel framework and tool is proposed** for assessing the alignment of MSP processes with EBA principles and to guide its operationalization



EB-MSP assessment tool structure

Structure of the new EB-MSP Assessment tool



130 tasks/actions to be addressed during MSP implementation process covering 10 cross-cutting topics

Six fields of information for each task/action (benchmarking):

- Implementation degree
- Relevance of each task/action
- Knowledge base (monitoring, expert knowledge...)
- Respondent confidence
- Implemented approaches, methods and tools
- Justification and additional comments

Consideration of high-level stakeholders' needs

Based on **experiences in EB-MSP implementation and their needs**



Country	N° attendees
Spain	9
France	2
United Kingdom	5
Germany	5
Belgium	1
The Netherlands	2
Denmark	1
Ireland	3
Greece	2
Italy	4
EU representatives	2
TOTAL	36

Workshop with high-level stakeholders (December 2023)

Assessing the alignment of EU MSP processes with ecosystem-based management principles



- Novel tool to assess the alignment of MSP processes with EBA principles
- Offers guidance and technical support for EB-MSP
- Identifies knowledge gaps and planning challenges
- Web tool with downloadable results



<https://aztidata.es/EB-MSP>

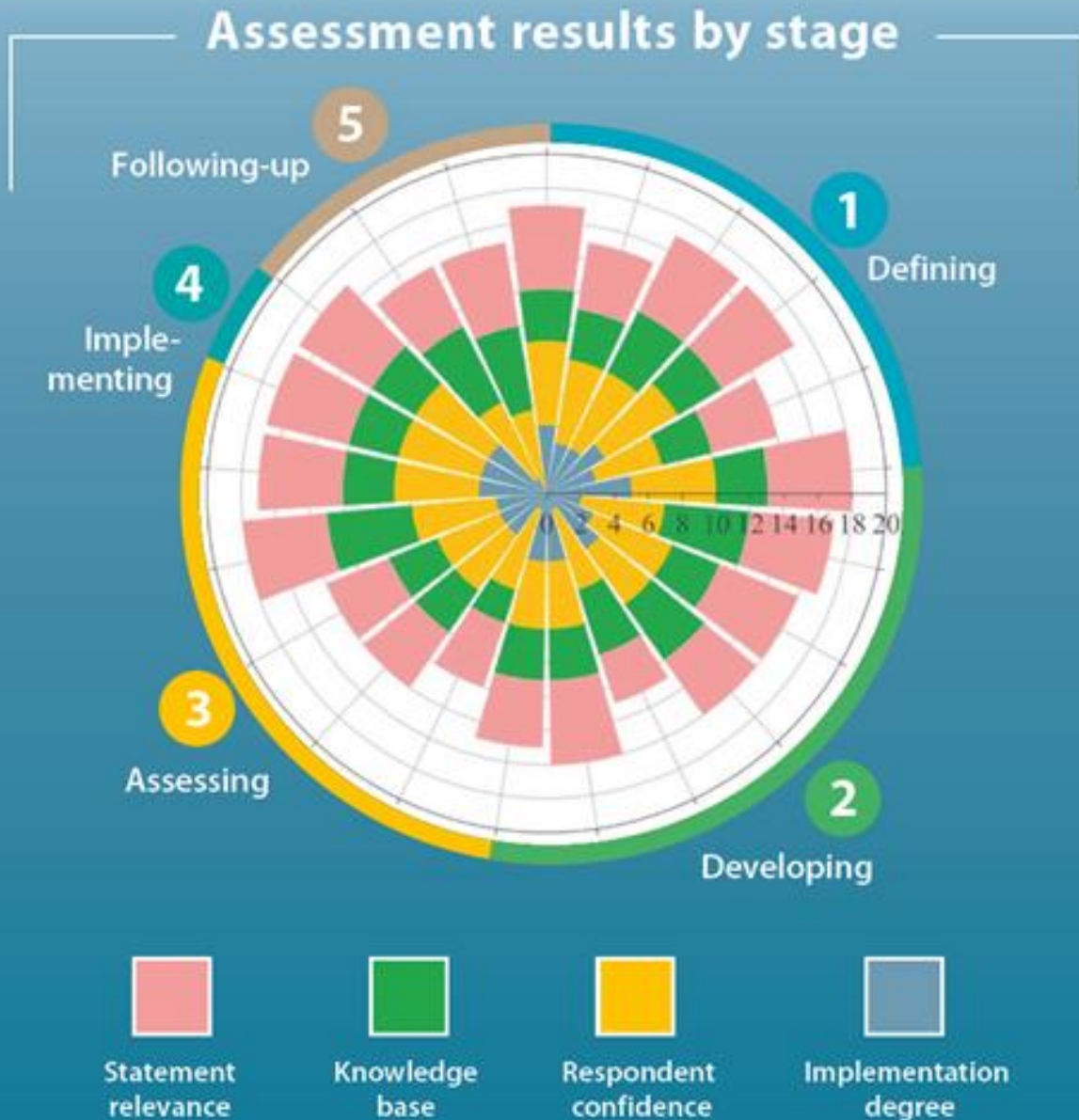
Galparsoro, I. et al., 2025. Assessment tool addresses implementation challenges of ecosystem-based management principles in marine spatial planning processes. Communications Earth & Environment, 6: 55
<https://doi.org/10.1038/s43247-024-01975-7>

Assessment of the EB-MSP process across EU countries

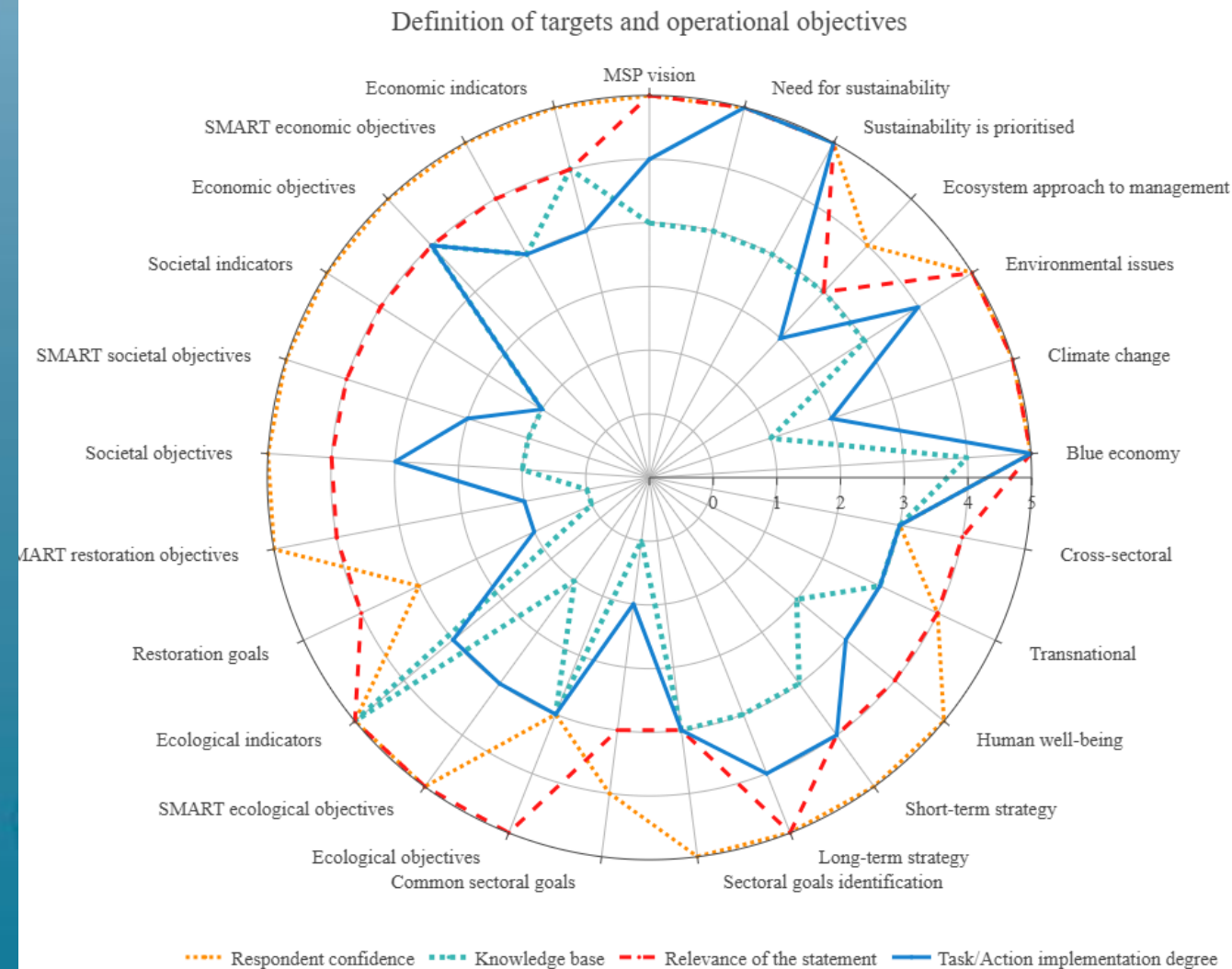


1. Azores
2. Belgium
3. France
4. Germany
5. Greece
6. Ireland
7. Italy
8. Netherlands
9. Spain
10. UK
11. Western Baltic Sea
12. Western Mediterranean Sea

Assessment of the EB-MSP process across EU countries



Assessment by EB-MSP cross-cutting topics



Main topics hindering the operationalization of EB-MSP in EU Member States?

Scientific knowledge on ecosystem processes and functioning

- Ecological carrying capacity and limits to its functioning
- Ecological connectivity
- Climate change scenarios and indicators

Definition of **targets and operational objectives**

- Societal objectives are SMART (specific, measurable, achievable, relevant, and time-bound)
- Climate change and its effects should be clearly specified

Future scenarios

- Trade-offs of different management options

Human activities and their effects

- A Cumulative Effects Assessment (CEA)

Approaches, **tools and methods**

- Uncertainty on background information is acknowledged when assessing planning options

Monitoring and evaluation

- The monitoring plan is adapted to integrate new data and knowledge

Strategic guidance

Identification of actions or tasks that have not been addressed or have only been partially addressed, but which are considered highly relevant for the planning site



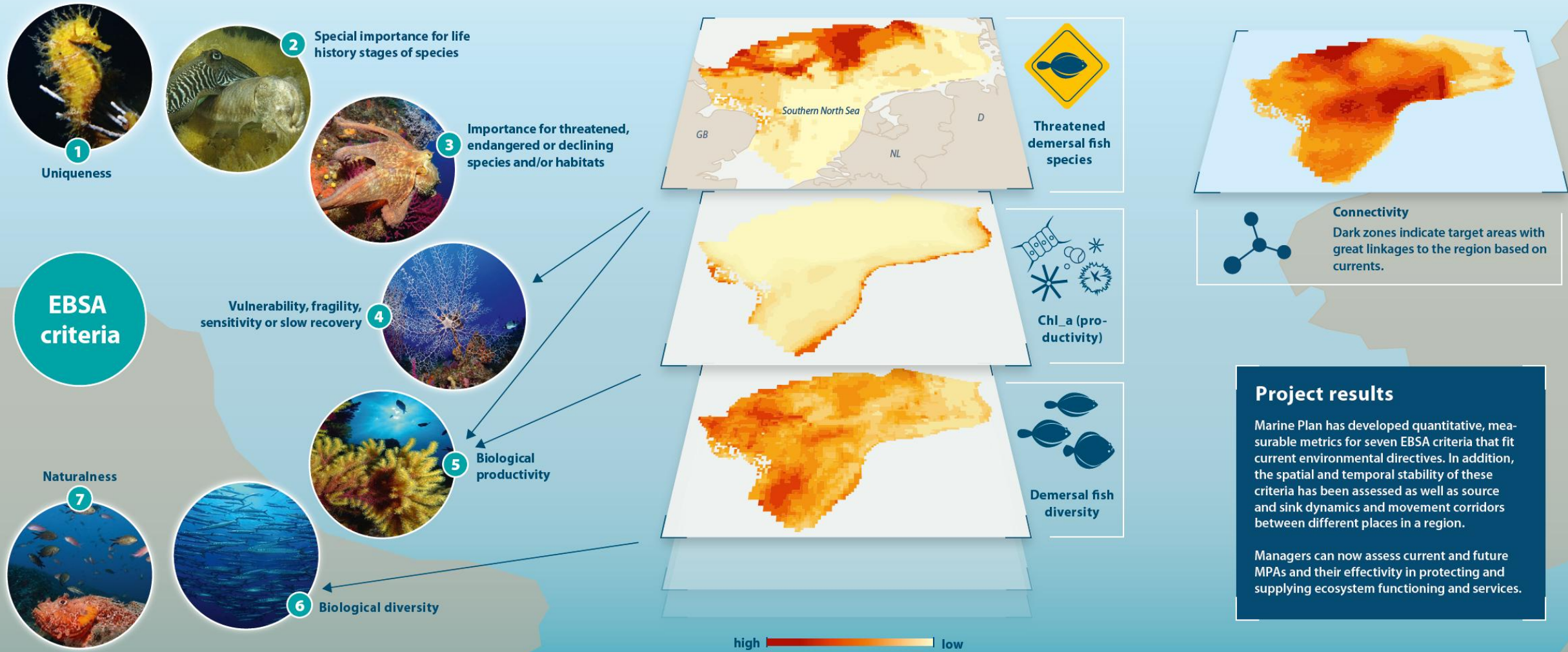
Room for improvement:

Examples of good practices

Links to approaches and methods

EBSAs (Ecologically or Biologically Significant Areas) & Connectivity

MarinePlan regards the operationalization of ecologically or biologically significant marine areas (EBSA) criteria as a main tool for MPA (Marine Protected Area) designation. A prerequisite for Planning Sites to develop scenarios and planning options is a robust science base for the prioritization and zonation of MPA networks by measuring the spatial distribution of existing and newly developed EBSA criteria.



Ecologically and Biologically Significant Areas (EBSAs)

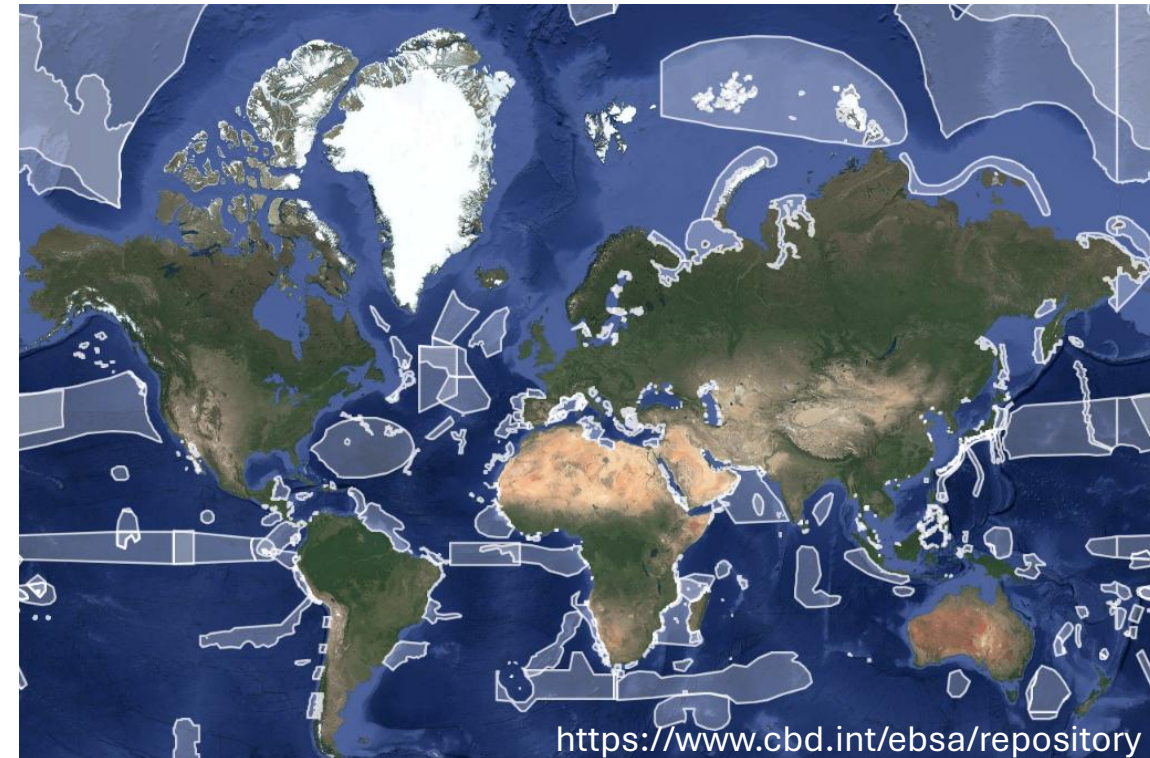
“An area of the ocean that has special importance in terms of its ecological and/or biological characteristics, such as providing essential habitats, food sources, or breeding grounds for particular species.”

These areas are recognized under the framework of the Convention on Biological Diversity (CBD) and are intended to inform marine conservation and spatial planning efforts.

Not legally binding, and most do not have any management measures

EBSAs are identified based on seven criteria:

1. Uniqueness or rarity
2. Special importance for life history stages of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, fragility, sensitivity, or slow recovery
5. Biological productivity
6. Biological diversity
7. Naturalness



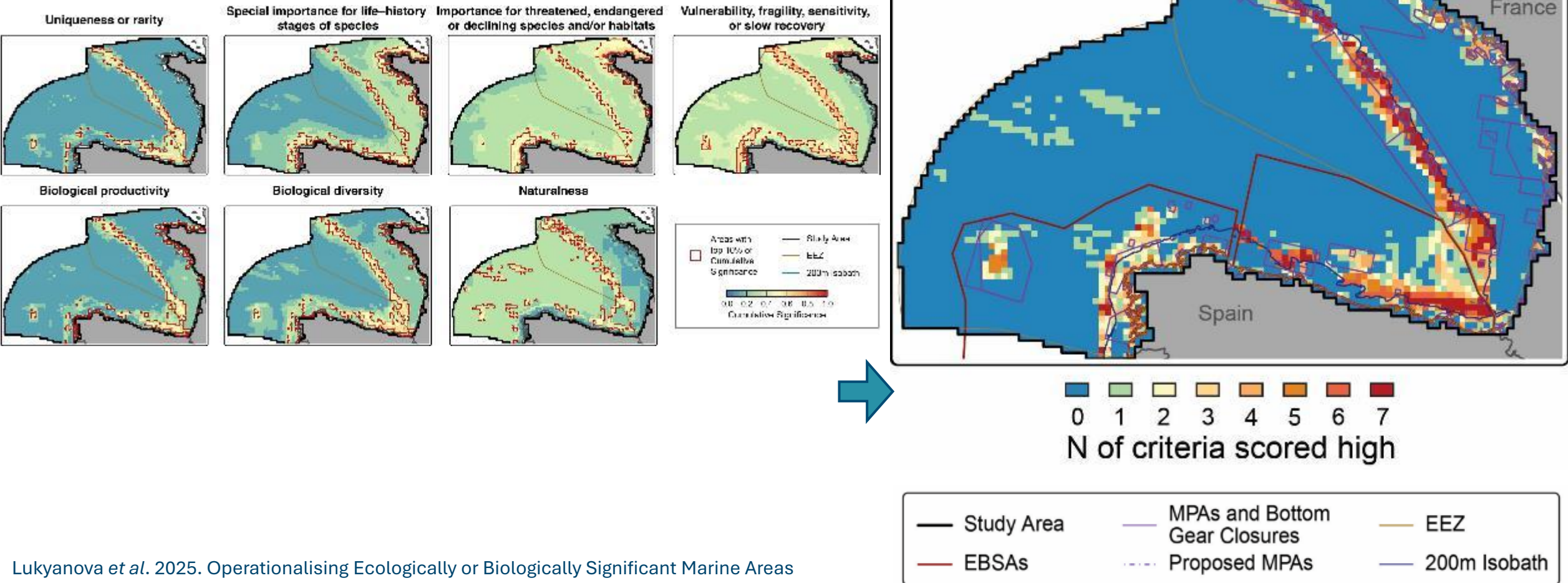
Why EBSAs?



- EBSA criteria **shift the focus** from particular species and habitats to **areas and processes crucial for ecosystem functioning and services**
- **Regional approach**
- **Guide marine spatial planning**
- **Support conservation strategies**
- **Inform policy decisions and international agreements such as the BBNJ Agreement and the Kunming-Montreal Global Biodiversity Framework**



Spatial analysis: Mapping EBSAs





Integrated, innovative and participative management of the Natura 2000 Network in the Spanish marine environment



Mapping of habitats of interest → spatial distribution and characterisation

Habitat modelling → production of full coverage maps

Assess the conservation status of habitats of interest

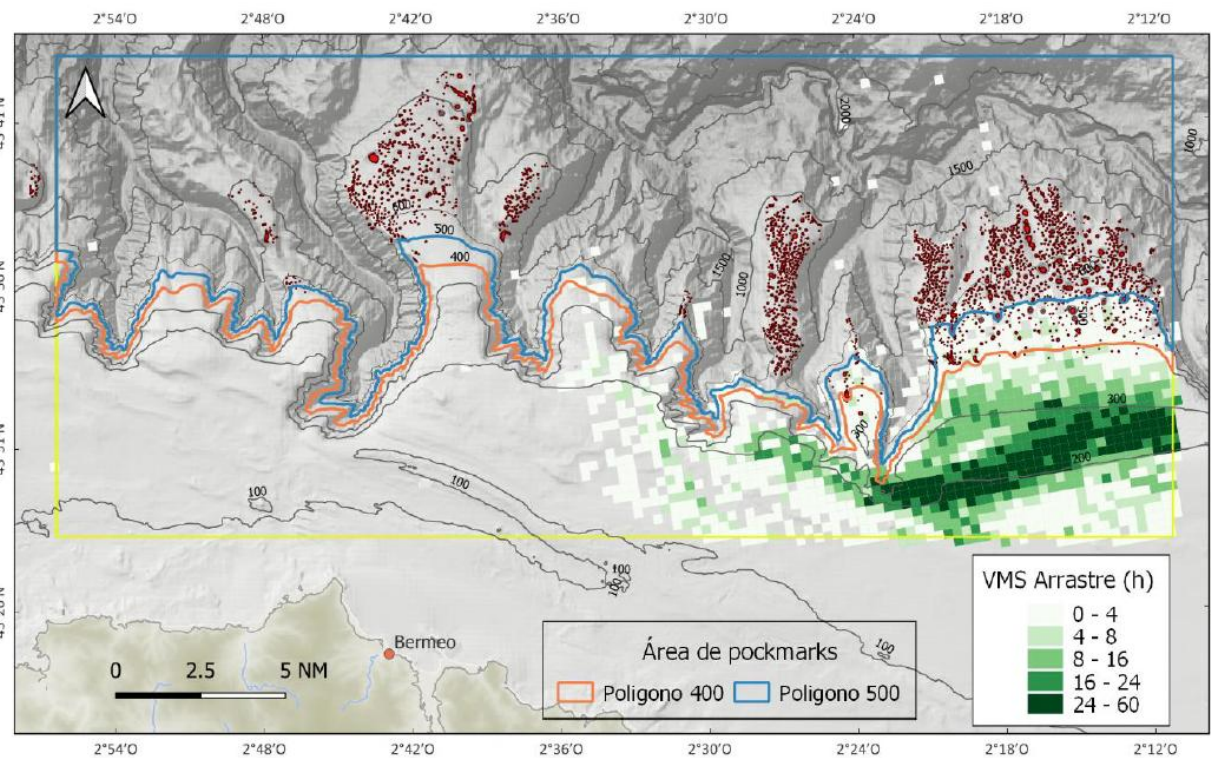
Characterisation of human activities → spatial distribution and intensity (industrial and artisanal fisheries)

Mapping interactions and risks for conservation

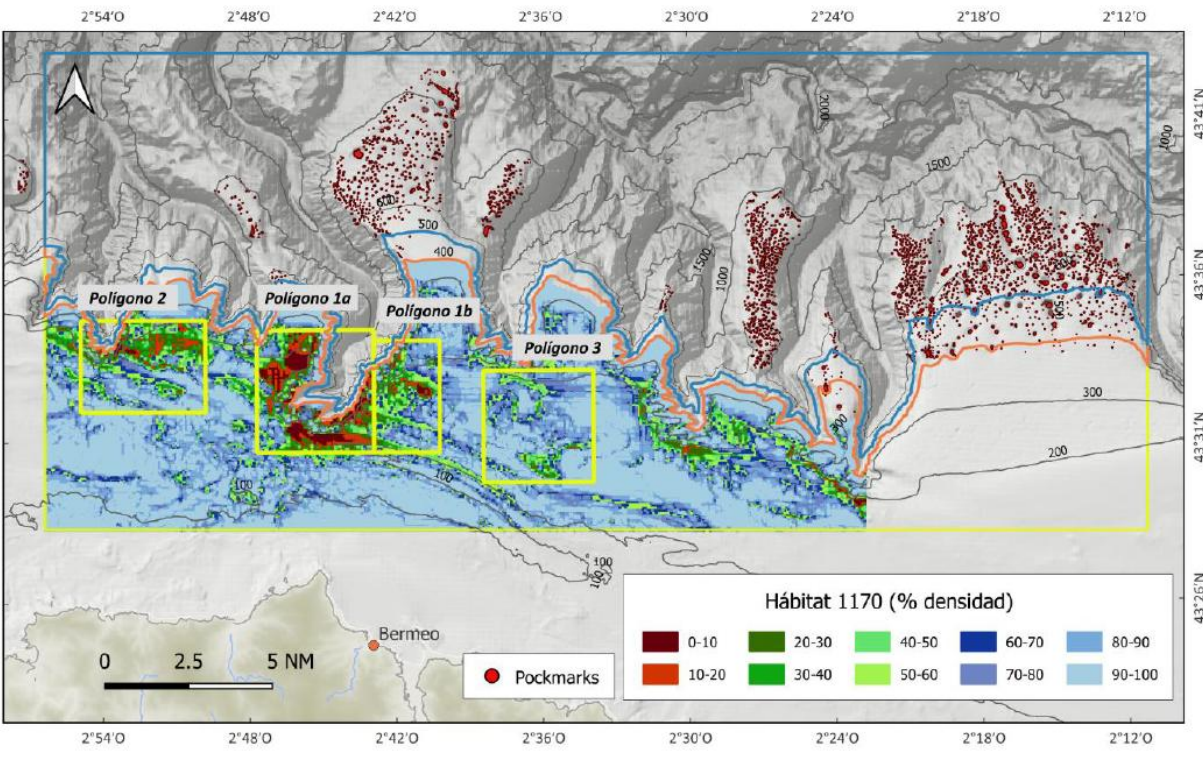
Inform spatial management plans



Preliminary proposal for zoning and management of the Site of Community Interest of the Capbreton submarine canyon system



Location of pockmarks (1180) (red circles) in relation to bottom trawling effort and polygons defined by the proposed SCI area and the bathymetric lines at 400 and 500 meters. Effort was calculated as the interannual average for the period 2017–2023 using a 500x500 m grid.



Polygons of highest ecological value in the study area. The yellow polygons indicate the best-preserved zones of the priority habitat 'Reefs' (habitat 1170) and areas of potential fisheries regulation; those outlined by the bathymetric lines at 400 meters (orange) and 500 meters (blue) depth, along with the northern, eastern, and western boundaries of the proposed Site of Community Importance (SCI) polygon, show the areas with the highest concentration of pockmarks on their intertributary platforms.

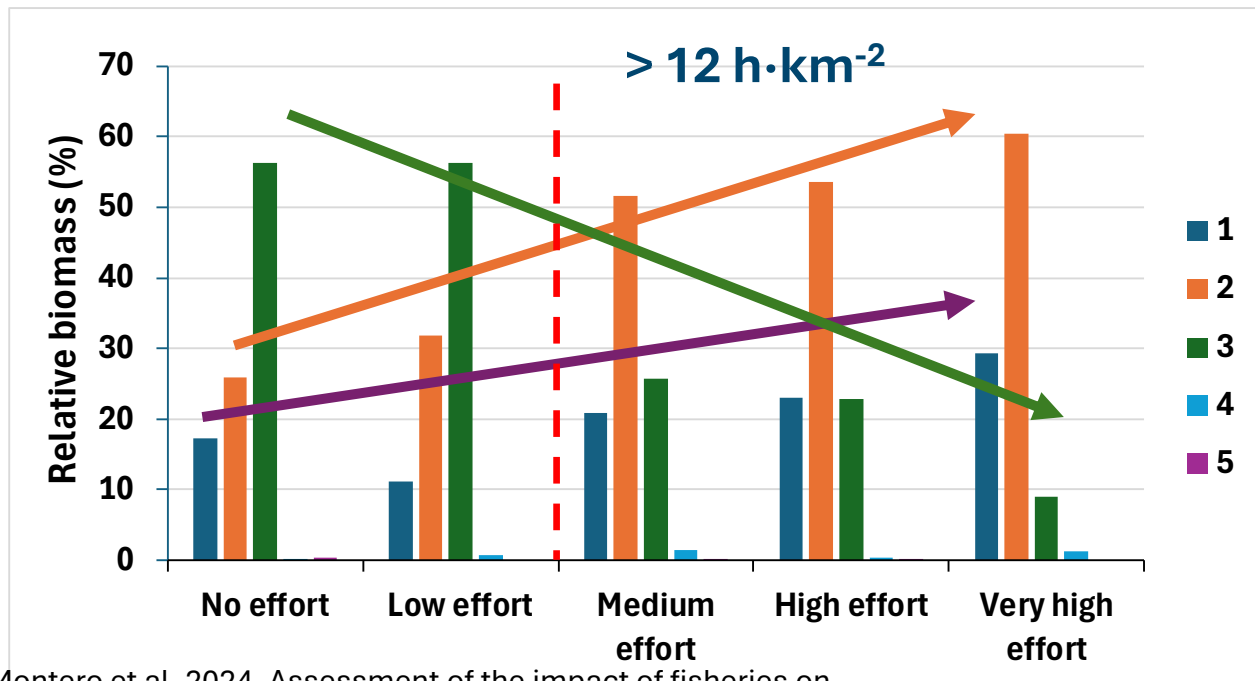
Trawling specific indicators/indexes

Benthos Sensitivity Index to Trawling Operations

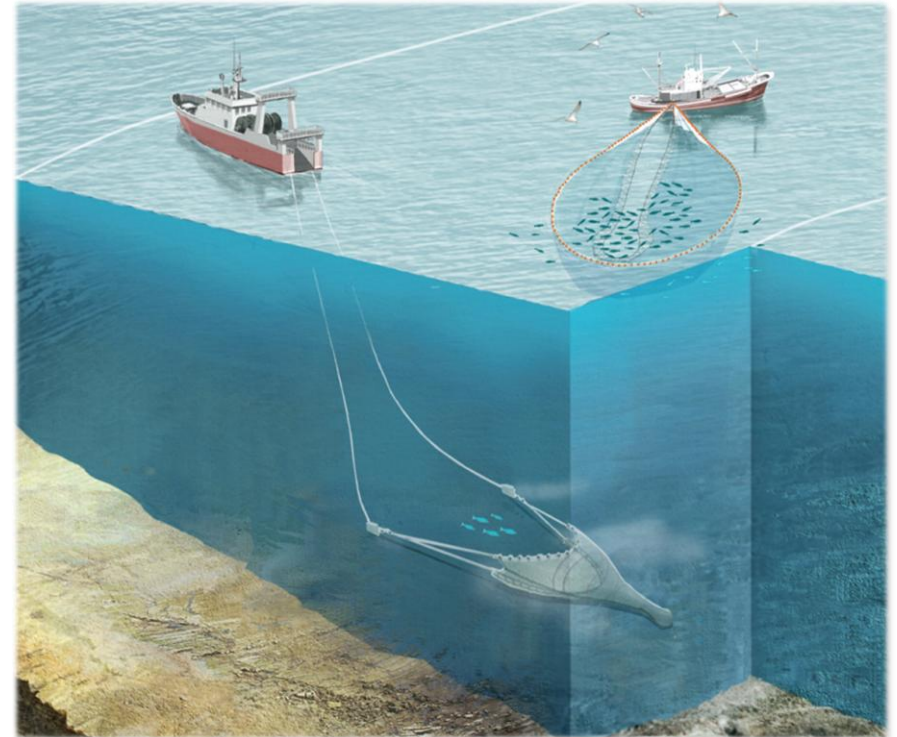
(González-Irusta *et al.*, 2018; Serrano *et al.*, 2022; de la Torre et al., 2022)

Biological traits: size, longevity, motility, attachment,
benthic position, flexibility, fragility,
feeding habit

Sensitivity score: 1- Opportunistic; 2- Tolerant;
3-5 Sensitive



Montero et al. 2024. Assessment of the impact of fisheries on sedimentary habitats of the Basque continental shelf

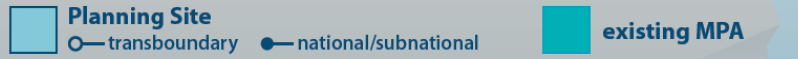
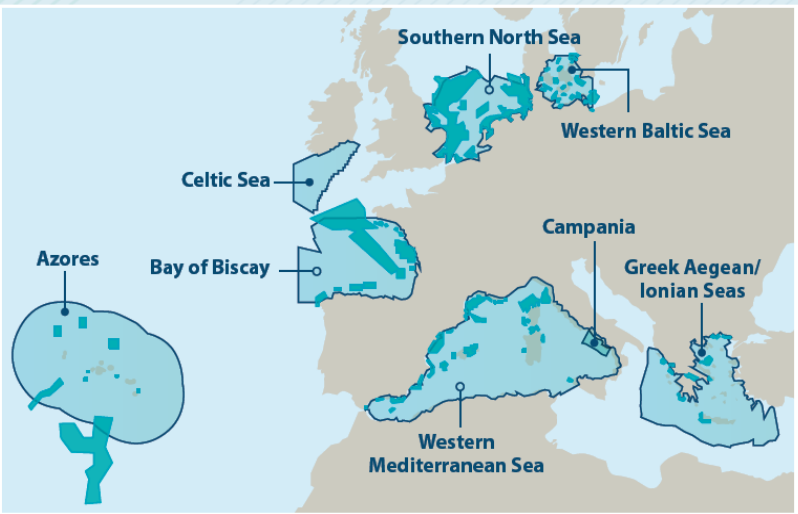


Spatial Planning Scenarios

MarinePlan will derive from planning scenarios lessons learned how to achieve 2030-30%-10% targets in the context of EB-MSP and derive key action points to foster EB-MSP implementation in European Seas. Applying the EB-MSP DSS requires tools for the prioritisation of conservation and restoration areas, the development of future scenarios, and related planning options

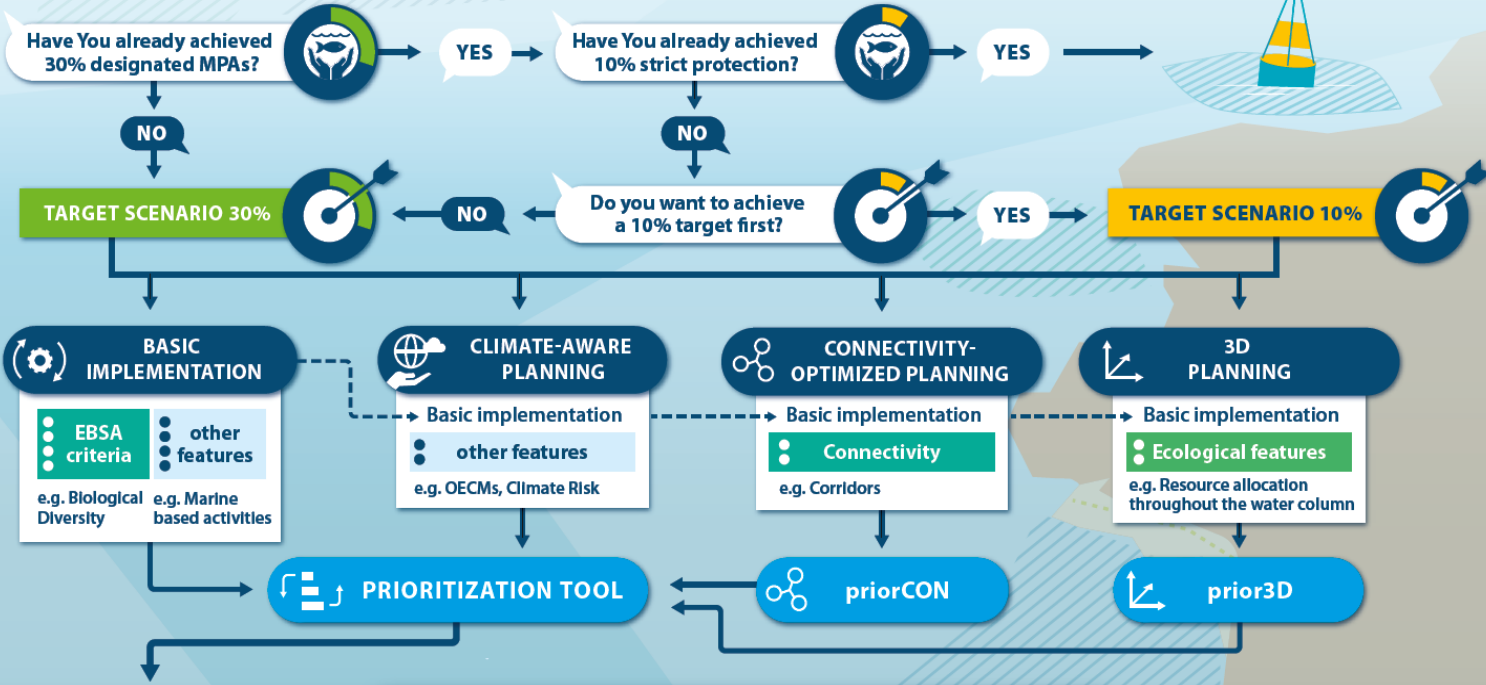
Planning Sites

Eight archetypal European MarinePlan Planning Sites have been selected to achieve a broad geographical coverage, encompassing the Baltic Sea, North Sea, Celtic Sea, Atlantic, and Mediterranean Sea. At these Planning Sites project partners will coherently apply the tools developed within the project to derive commonalities, success stories and impediments with regard to the co-development of feasible and realistic planning options to achieve EU Biodiversity strategy targets with the help of EB-MSP.



Decision Support Tree

A tool for the prioritisation of conservation and restoration areas, the development of future scenarios, and related planning options



OUTPUT SCENARIO

Potential output for transboundary planning in the Southern North Sea



Planning options



Peaceful Collapse

- The 10% strict protection target is partially achieved
- The 30% target is achieved by declaring new MPAs and OECMs
- Connectivity and ecological corridors are accounted for
- No climate change considerations (climatic refugia or future distributions are not considered)
 - Effective transboundary collaboration
 - 3D planning

Inadequate climate action

CLIMATE

Climate apocalypse

- The 10% strict protection target is not achieved
- The 30% target is achieved by declaring OECMs – no new MPAs
 - Connectivity and ecological corridors are ignored
- No climate change considerations (climatic refugia or future distributions are not considered)
 - No transboundary collaboration
 - 2D planning

Environment /
peace oriented

POLITICS

INTERN.
Economic growth/
conflict oriented

Sustainable Harmony

- The 10% strict protection target is achieved
- The 30% target is achieved by declaring new MPAs and OECMs – additional measures are taken in OECMs to enhance conservation outcomes
- Connectivity and ecological corridors are accounted for
- Climatic refugia and future distributions under climate change are considered in spatial planning
 - Effective transboundary collaboration
 - 4D planning

CHANGE

Commitment for mitigation

Battles and Breaths

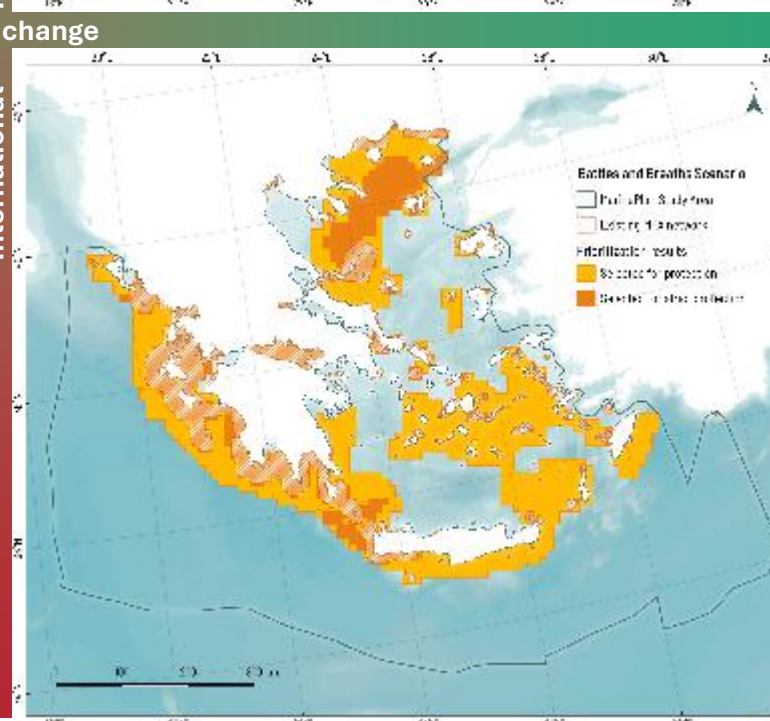
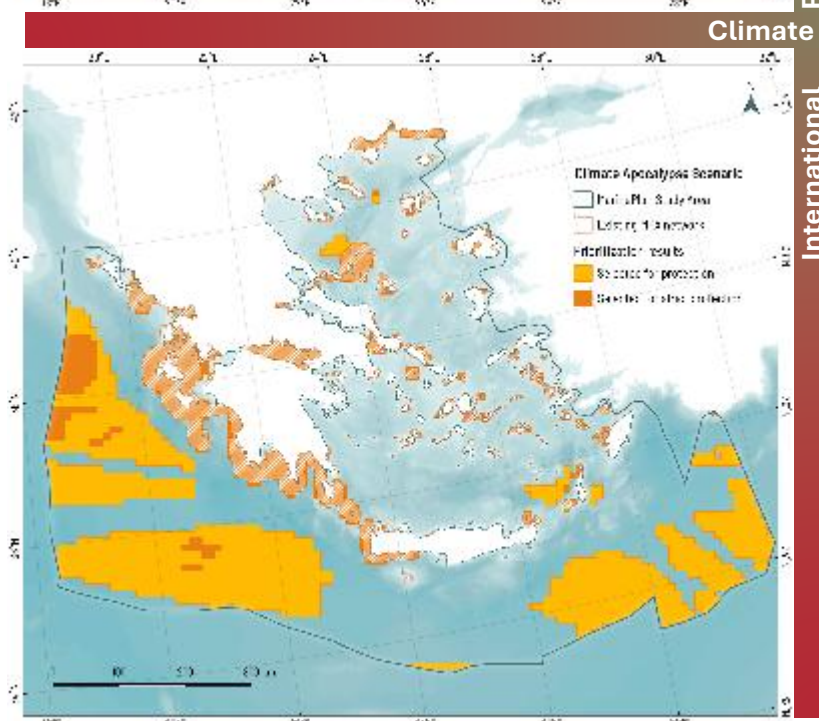
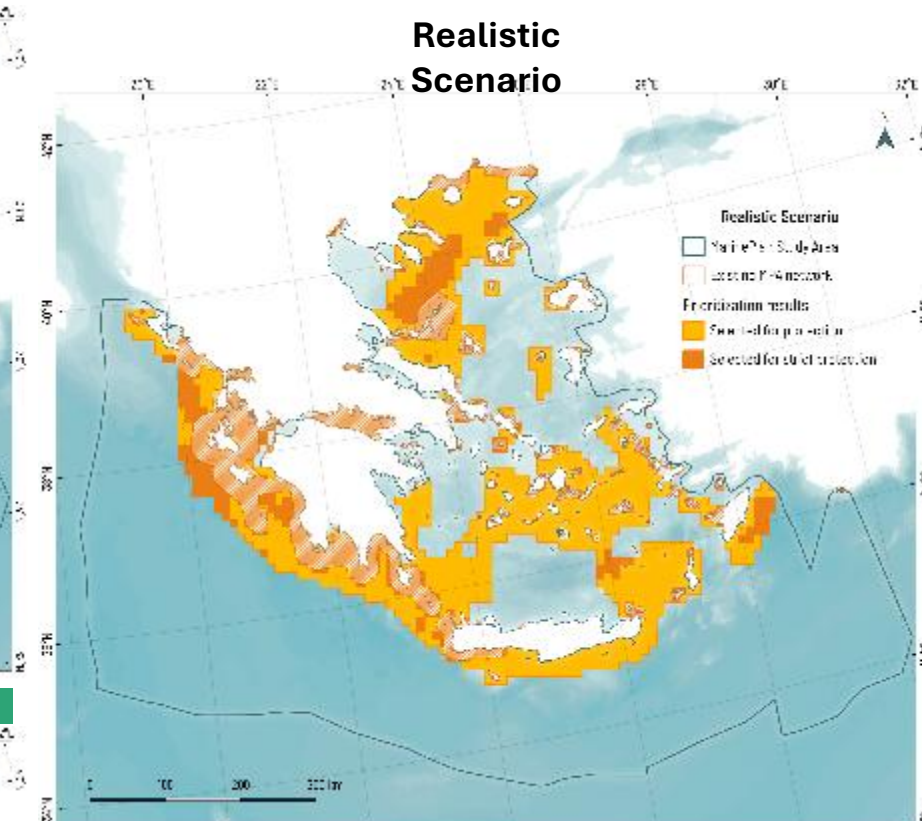
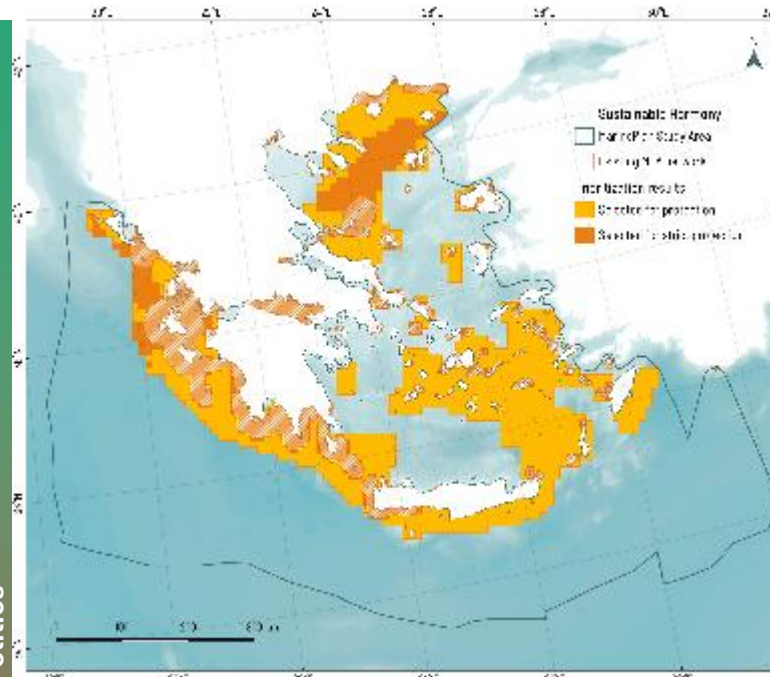
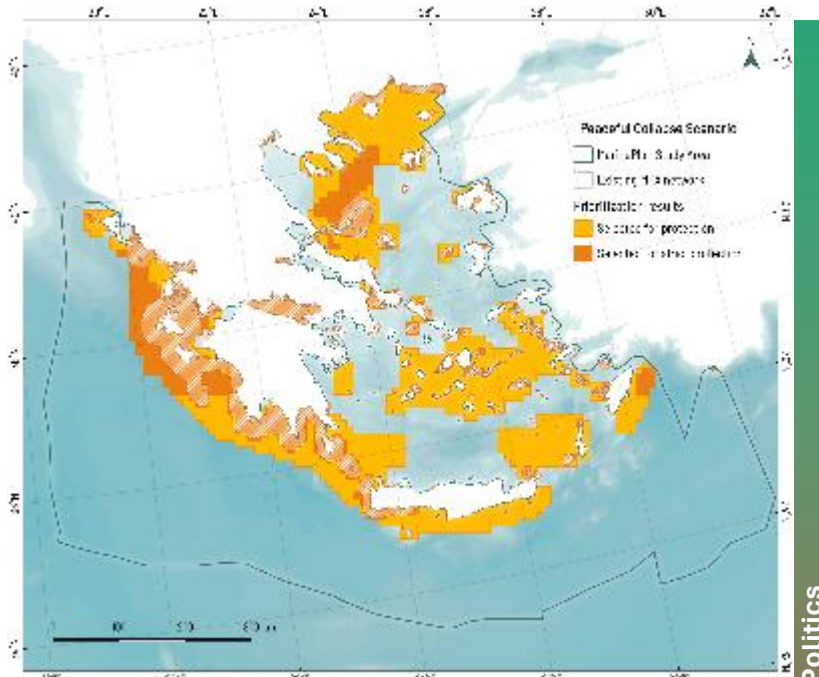
- The 10% strict protection target is partially achieved
- The 30% target is achieved by declaring new MPAs and OECMs
 - Connectivity and ecological corridors are accounted for
- Climatic refugia and future distributions under climate change are considered in spatial planning
 - No transboundary collaboration
 - 4D planning

Planning options



Tools	Realistic option	Climate apocalypse	Battles and Breaths	Peaceful Collapse	Sustainable Harmony
2D planning (e.g., MARXAN, prioritizr)		Y			
prior3D (3D planning)	Y		Y	Y	Y
priorCON (connectivity analysis)	Y		Y	Y	Y
ecological corridors	Y		Y	Y	Y
priorOECM	Y	Y	Y	Y	Y
climate risk and 4D planning	o		Y		Y
alternatives for cost layers	Y		Y	Y	Y

Y: YES – o: optional



- Some priority areas emerge consistently across scenarios
- Under-sampled (offshore) areas are deprioritized.
- Cost and weighting schemes shape outcomes, especially for strict protection.
- Realistic Scenario balances ambition with feasibility.

Stakeholders and Governance

To identify future pathways for marine governance, it is vital to understand how objectives are prioritised, how stakeholders participate and share knowledge, and how regimes adapt to change. To develop insight on these aspects, the following activities were conducted:

- An institutional and policy audit of each study site, enabling an analysis of how marine governance is operationalised;
- An assessment of the adaptive capacity of governance to identify what impedes and facilitates the implementation of new approaches.



Institutional and legislative audit

Many regions have constructed complex legislative and administrative frameworks, managed by a plethora of organisations and administrations that attempt to respond to international, national and regional policies. This has facilitated ineffective communication, weak coordination and limited integration across governance regimes.

ADMINISTRATIVE FRAMEWORKS (e.g. France)

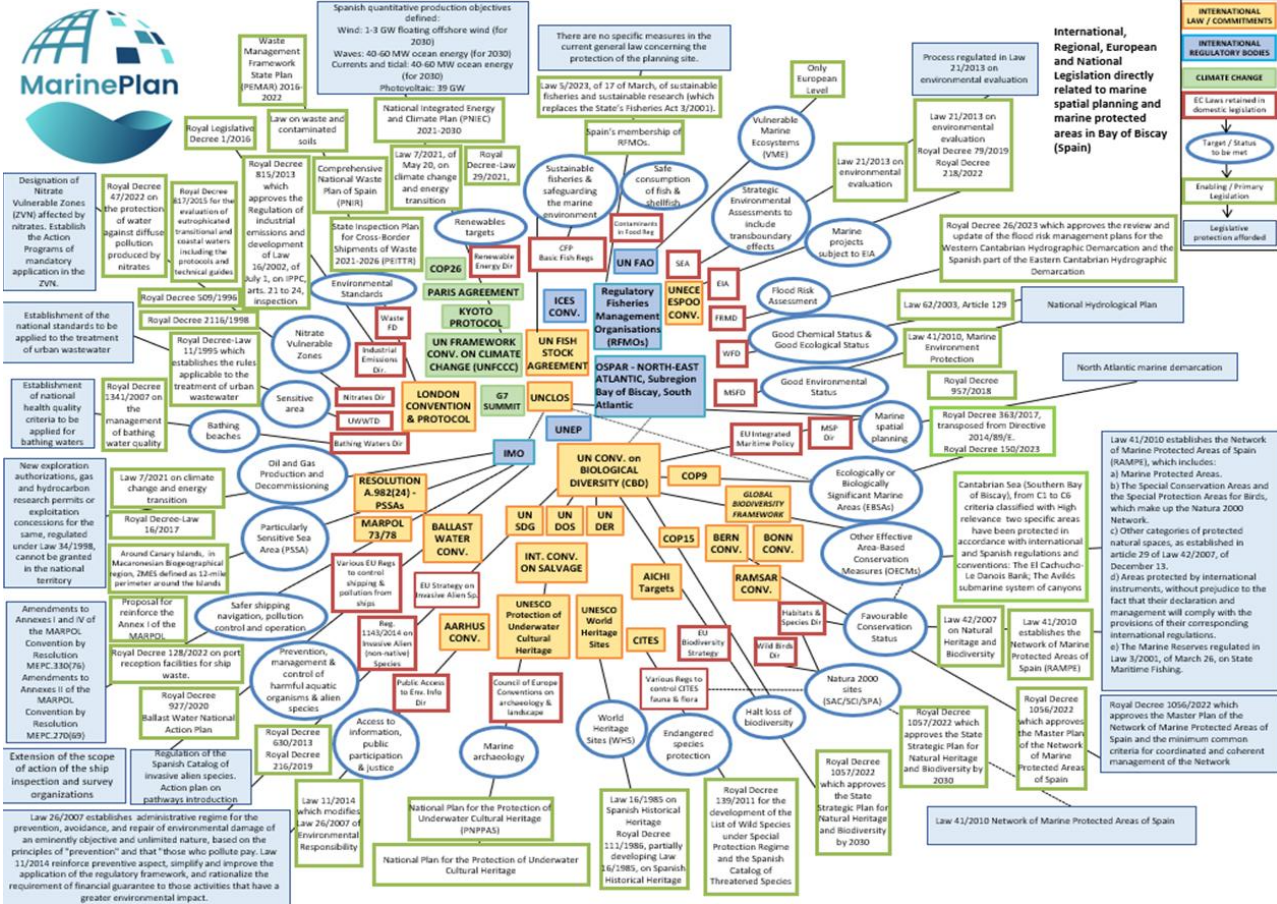


ADMINISTRATIVE FRAMEWORKS (e.g. Netherlands)

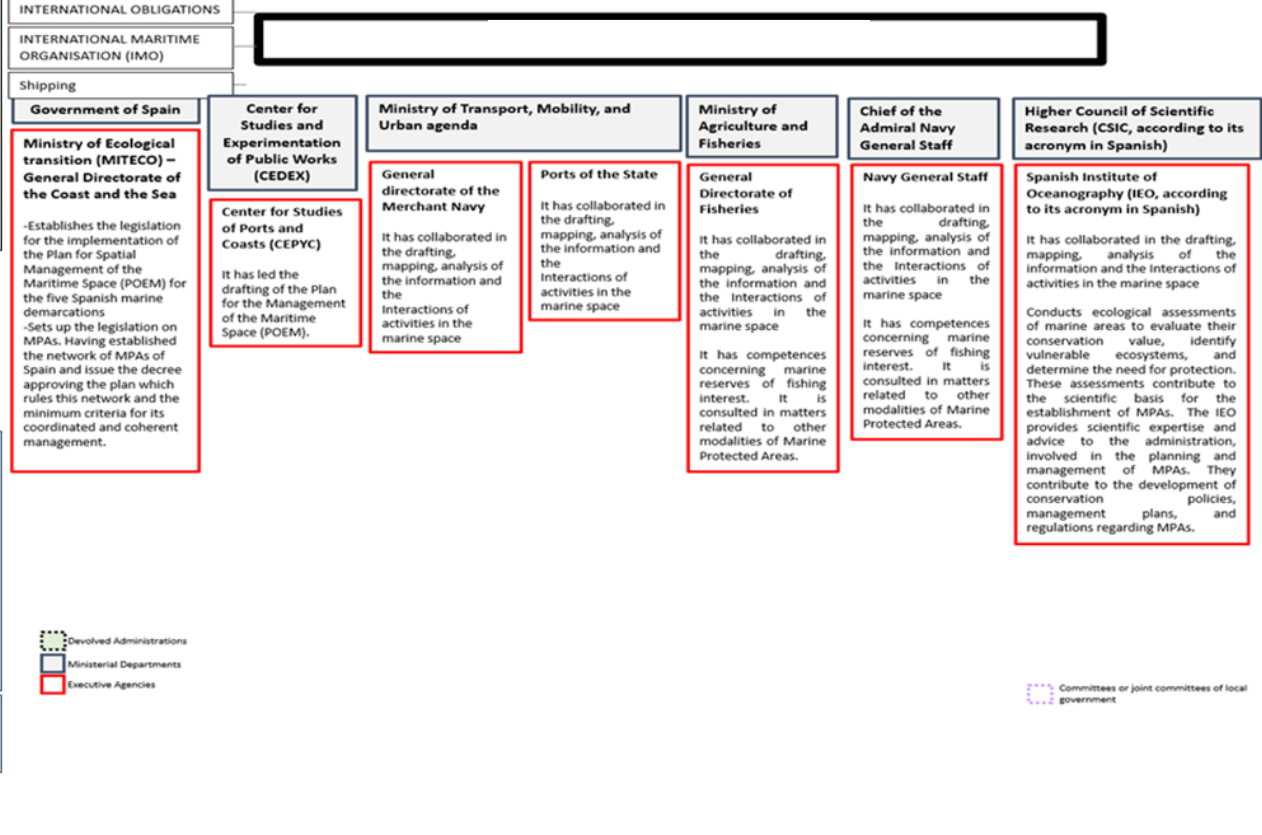


- Analysis of existing policies and institutions
- Barriers to adopting novel and dynamic approaches to Marine Protected Areas designation and implementation
- Transferable good practices and policy recommendations

“Horrendograms” illustrate the intricate legislative frameworks



Organograms illustrate the intricate organisational framework in each region



Countries have comprehensive, multi-level legal frameworks for maritime management, involving several government departments. This complexity leads to challenges: limited interdepartmental communication, duplication, and uncertainty about responsibilities—especially for cross-border cooperation and setting regional objectives.

There is a lack of cross-border consultation with regional stakeholders to define common objectives or environmental issues.

Interviews

Institutional and policy audit

- Competent authorities

Assessing Adaptive Capacity

- National authorities
- Fishermen associations
- Renewable energy sector
- Energy sector
- eNGOs

+ open questionnaire

	<u>Barrier 1</u>	<u>Barrier 2</u>	<u>Barrier 3</u>	<u>Barrier 4</u>
<u>Azores</u>	Regional and national complexity	Key scientific knowledge gaps	Insufficient monitoring mechanisms	Insufficient enforcement mechanisms
<u>Bay of Biscay</u>	Limited cross-border cooperation	Ineffective management measures	Impaired interaction between sectors	Emergence of the offshore energy sector
<u>Campania</u>	Ineffective consultation activity	Lack of ecological connectivity among MPAs	Lack of stability in MPA management and monitoring	Lack of political will
<u>Celtic Sea</u>	Lack of capacity	Fragmented governance and data	Competing objectives	Ineffectiveness of legislation

	<u>Barrier 1</u>	<u>Barrier 2</u>	<u>Barrier 3</u>	<u>Barrier 4</u>
<u>Greek Aegean and Ionian Seas</u>	Delay in policy implementation	Weak communication between government departments	Lack of key personnel in governance	Science-policy disconnect
<u>Southern North Sea</u>	Policy complexity and fragmentation	Limited harmonization of conflicting priorities	Uneven stakeholder involvement in MSP	Weak monitoring mechanisms to evaluate MPA effectiveness
<u>Western Baltic Sea</u>	Key scientific knowledge gaps	Weak monitoring mechanisms to evaluate MPA effectiveness	Impaired interaction between sectors	Limited cross-border cooperation in identifying priorities
<u>Western Mediterranean Sea</u>	Disconnect between MSP and MPA processes	Limited cross-border cooperation in identifying priorities	Uneven stakeholder involvement in MSP	Stakeholder fatigue caused by heightened expectations

	<u>Rec. 1</u>	<u>Rec. 2</u>	<u>Rec. 3</u>	<u>Rec. 4</u>
<u>Azores</u>	Strengthened intergovernmental dialogue & a revision of competencies	Expand research initiatives and emerging technologies	Establish clear evaluation protocols based on SMART indicators	Integrate remote surveillance & inter-departmental data-sharing
<u>Bay of Biscay</u>	A transboundary MSP cooperation framework in the context of the already existing initiatives	Review French and Spanish marine governance & develop a harmonization roadmap	Develop joint, low-risk projects between maritime sectors	Analyse the cumulative impacts of designating areas for renewable energy facilities
<u>Campania</u>	Legislation to make public consultations a mandatory component of MPAs	Scientific assessment to identify key ecological corridors that link different MPAs	Hire qualified personnel at all levels & simplify bureaucratic procedures for management agencies	Identify political figures who can act as champions for the marine environment
<u>Celtic Sea</u>	Assess what type of resources are required & delegate tasks to address issues	Enhance cross-departmental working groups & designate integration champions	Build on Project Ireland Marine by aligning marine policies and investment	Establish clear evaluation protocols based on SMART indicators

	<u>Rec. 1</u>	<u>Rec. 2</u>	<u>Rec. 3</u>	<u>Rec. 4</u>
<u>Greek Aegean and Ionian Seas</u>	Develop an actionable plan on how to achieve MSP and MPA targets	Regulatory framework on how cross-departmental cooperation can be operationalised	Hire qualified personnel at all levels & simplify bureaucratic procedures for management agencies	Develop clear procedures for receiving, evaluating, and incorporating scientific advice into policy
<u>Southern North Sea</u>	Establish cross-border planning mechanisms and strengthen institutional collaboration	Create formalised steering committees that link to cross-border dialogue	Build on the Greater North Sea Basin Initiative to coordinate offshore wind & multi-use site selection	Establish clear evaluation protocols based on SMART indicators
<u>Western Baltic Sea</u>	More standardized, long-term, and spatially comprehensive monitoring efforts	Establish clear evaluation protocols based on SMART indicators	Develop joint, low-risk projects between maritime sectors	A transboundary MSP cooperation framework in the context of the already existing initiatives
<u>Western Mediterranean Sea</u>	Develop MSP and MPA roadmaps to guide alignment between the processes	A transboundary MSP cooperation framework in the context of the already existing initiatives	Formalised steering committees that include sectoral representatives and facilitators to work with less experienced stakeholders	Reinforce eNGO collaborations by fostering strategic coalitions that share responsibilities and resources

Conclusions



Marine area is getting crowded and effective management is needed more than ever

Conservation objectives and renewable energy growth objectives are ambitious, which will require further coordination to minimise negative impacts

Marine conservation and restoration has to be integrated into a broader ecosystem-based management

Marine conservation and restoration should shift the focus from particular species and habitats to processes crucial for ecosystem functioning and services

A number of specific actions should be addressed to improve the effectiveness of the plans: ecological carrying capacity, definition of specific ecological, economic and social objectives, data gaps, development of future scenarios to assess trade-offs of different management options

We shouldn't forget about "basic science" to further understand ecological processes, which will help us understanding the effects of existing and future activities and effects of adopted management plans

Research of marine protected
habitats in EEZ and determination
of the necessary conservation
status in Latvia



Thank you!

MarinePlan

Improved transdisciplinary science for effective ecosystem-based maritime spatial planning and conservation in European Seas

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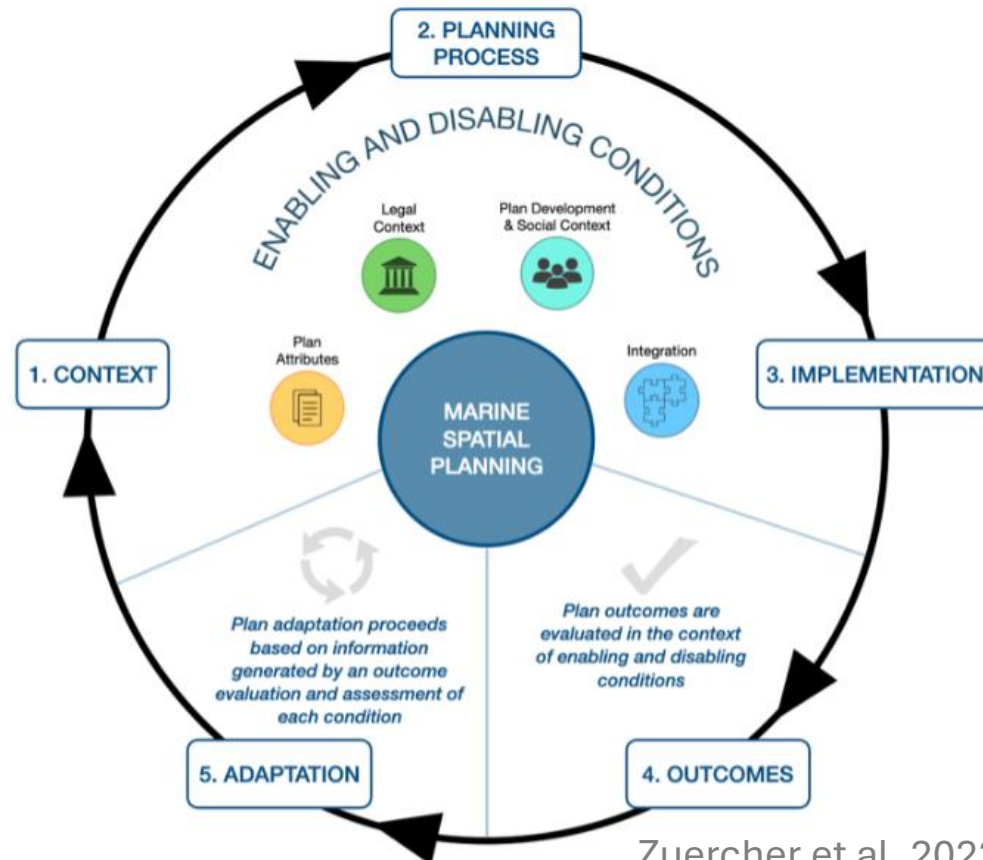


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Maritime or Marine Spatial Planning (MSP) Process



- MSP is a step-wise process that allocates the spatial and temporal distribution of human activities in marine areas **to achieve ecological, economic, and social objectives** (Douvere 2008; Foley et al. 2010)



Zuercher et al. 2022

KEY CHARACTERISTICS OF MARINE SPATIAL PLANNING



ECOSYSTEM-BASED

Ensures the health of marine ecosystems



INTEGRATED

Coordinates across sectors (fishing, tourism, energy, etc.)



PLACE-BASED

Tailored to specific marine areas and conditions



ADAPTIVE

Uses an iterative process to respond to change



STRATEGIC & LONG-TERM

Focuses on long-term goals and sustainability



PARTICIPATORY

Involves stakeholders, including the public



LEGALLY SUPPORTED

Backed by legal and institutional frameworks



DATA-DRIVEN

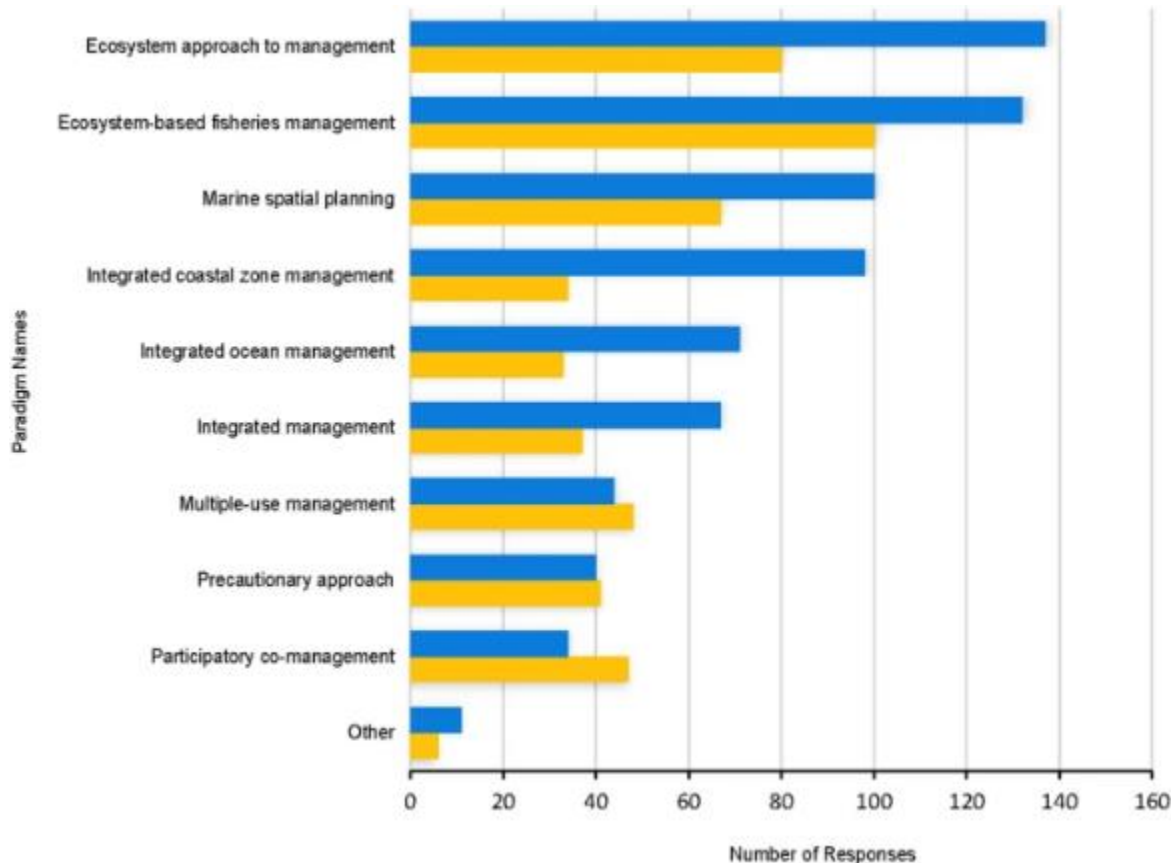
Relies on best available scientific data



TRANSPARENT

Ensures open processes and accountability

Many Tools for EBM Implementation



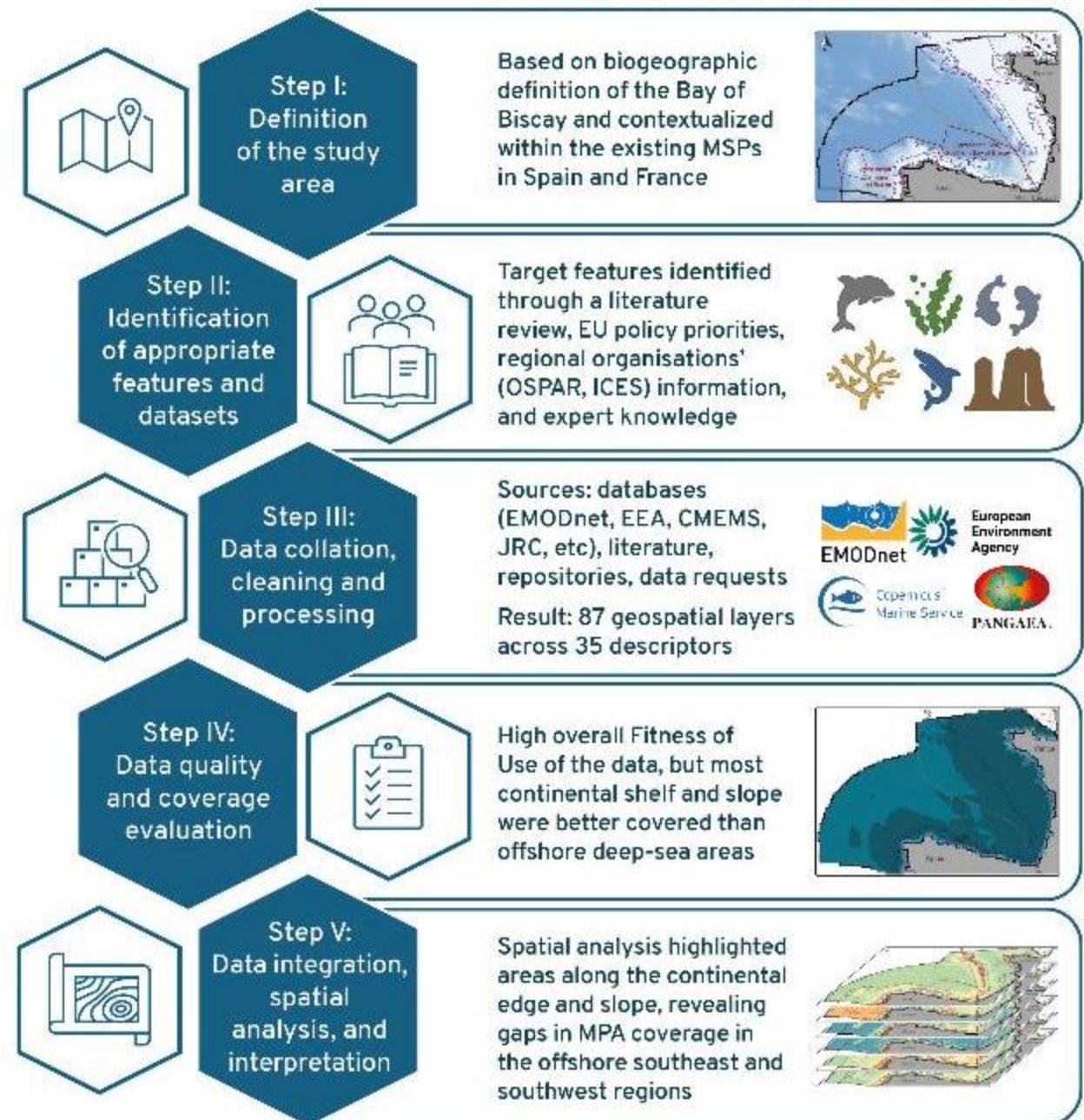
Haugen et al. 2024

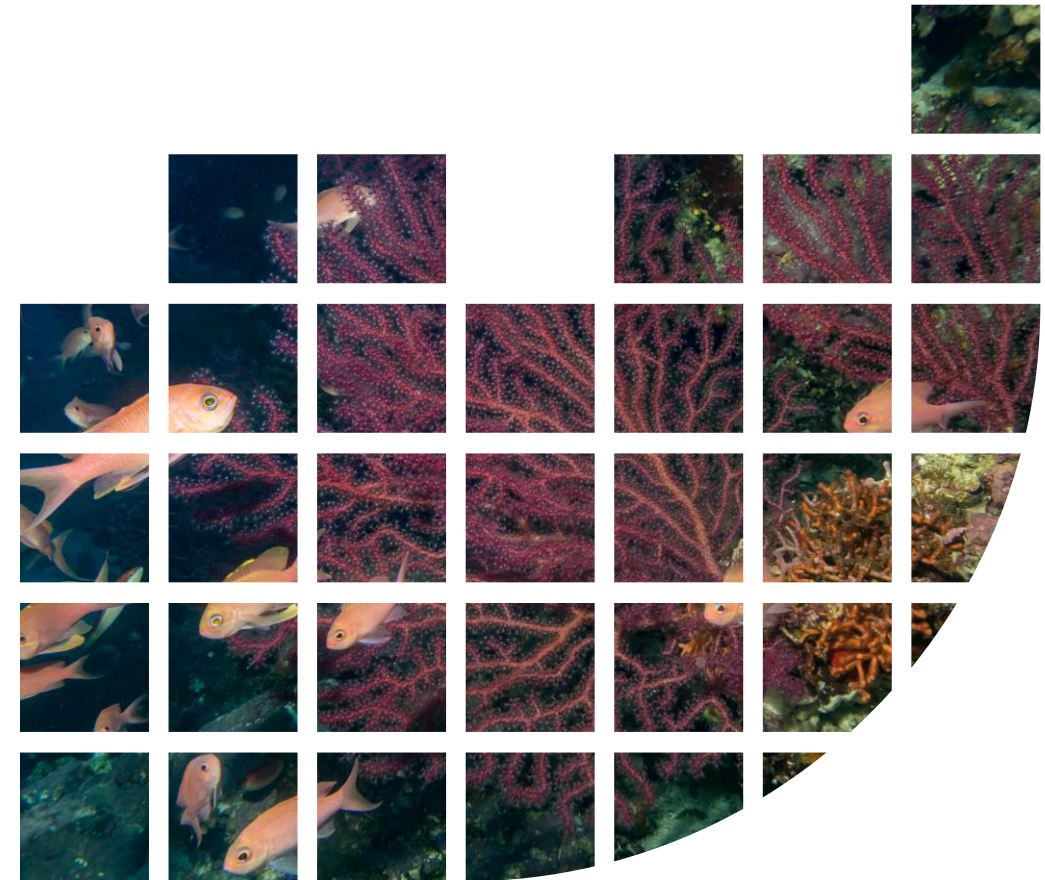
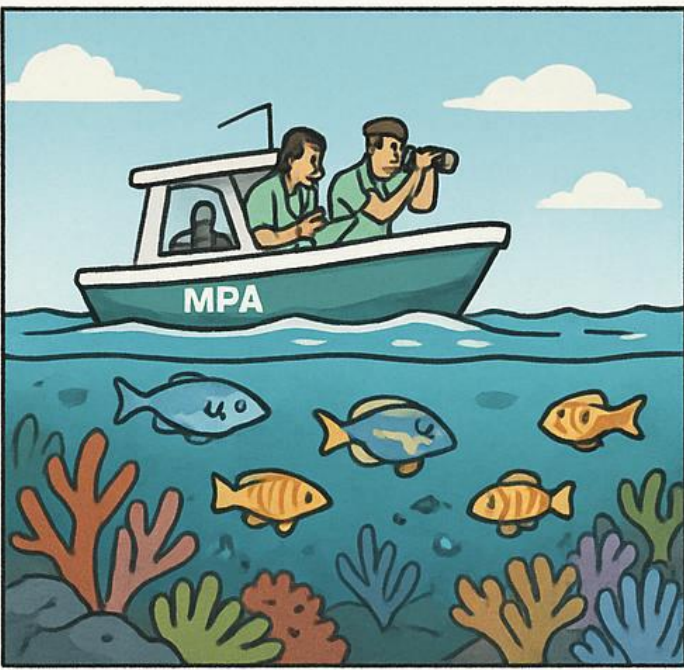
- Marine Spatial Planning (MSP; Ehler and Douvere 2009)
- Integrated Ecosystem Assessment (IEA; Levin et al 2009)
- Systematic Conservation Planning (SCP; Pressey and Bottrill 2009),
- Integrated Oceans Management (IOM; Foster et al 2005)
- Ecosystem Approach to Fisheries/Management (EAF/M or EBM; Arkema et al 2006; Fletcher and Bainchi 2014; Long et al 2015).

Results from the poll where the participants were asked if they had heard Ecosystem-Based Management (EBM) called by other names or linked to other paradigms (top blue bar; $n = 153$) and if participants work on other EBM-related topics (bottom yellow bar; $n = 147$).

Operationalisation framework

IMPLEMENTATION EXAMPLE: BAY OF BISCAY





The future isn't predicted — it's planned.